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THE CARPENTERS' GUIDE

BY

HARVEY MILLER

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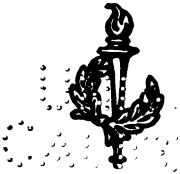
THE CARPENTERS' GUIDE

Treating on Lines and the Square

ALSO

Giving Practical Rules and Methods on Carpentry



BY

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UNIV. OF CALIFORNIA

INTRODUCTORY SET

A long felt need on a work to explain carpentry in a brief, practical way has induced me to write this little book, giving rules and illustrations that will be helpful as a guide to the Mechanic, Apprentice or Student in manual training in developing ideas of construction.

It is not our aim to illustrate every possible cut that is to be made with the square, but to give simple rules and illustrations which will, by studying their methods, be a guide in making any cut desired.

By the use of the steel tape-line, square, plumb, level and lines, one may demonstrate all illustrations with the rules herein given.

The student may work them out by square-root or geometry, as all framing is based on horizontal perpendicular and angular lines; but we will treat them in the way they are practically used.

The uses of lines and measurements will

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be explained, as well as the use of the square. The line is used in locating, laying out, and squaring a building, also in lining walls, forms, partitions, plates, measurements, etc.; hence the importance of lines and their uses.

Practical methods will be given of the square as we have used it in construction for twenty-five years. The method is the same, whether cutting a rafter for a garage, school, church, house or any other building.

The square is familiar to nearly every man, woman and child, and is looked upon as a mysterious tool. There are 3 lines that will give any cut in framing to be made with the square, the base, rise and hypotenuse.

The rules and illustrations given in this booklet will enable you to make any cut desired, and understand the use of the square in obtaining pitch of roof, length and cut of rafters, braces, etc., also in Truss bridging and bracket framing. Our aim in compiling this booklet is to give to others the practical methods that would have been a guide to us as Apprentices and Mechanics.

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TO LOCATE A BUILDING

Draw a line in the street 200 feet or more, in front of the intended structure parallel with the street or road, then measure in from this line at two different points to establish the line for the front wall parallel with the one in the street. Locate the two front corners of the building. All other walls and corners must be located and squared from this front wall line. (See

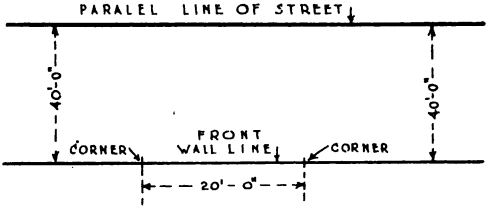

FIG. 1
LOCATE A BUILDING

fig. 1.) In this illustration, the wall line is set back 40′ from the street line. The building is 20′x24′. The two front corners are 20′ apart, located on the front wall line.

TO STAKE OUT A BUILDING

From the established corners on front wall measure and stake the approximate lo-

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cation of the other corners and drive three stakes in a triangle two or more feet outside of the wall lines, place two boards (termed batter boards) at each corner to be nailed on the stakes when the grade is established and the building leveled. (See fig. 2.)

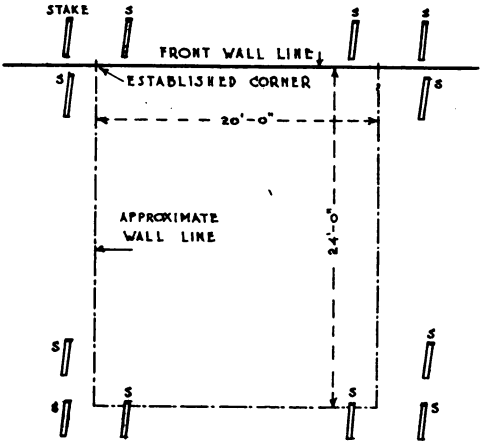

FIG. 2
TO STAKE OUT A BUILDING

THE GRADE OF THE BUILDING

The grade is an established line from

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which all measurements are taken for the height of the building and the depth of the basement. This grade line is the top of the wall or bottom of the sill.

Take a general survey of the surrounding grounds to obtain the proper height for grade line and mark on one of the front corner stakes the desired height. From this grade mark all other corners and angles are to be leveled. (See fig. 3.)

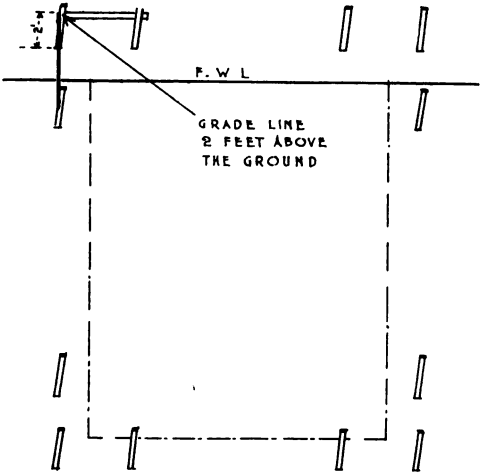

FIG. 3

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TO LEVEL A BUILDING

To the stake designating the height of wall or grade line nail the batter boards

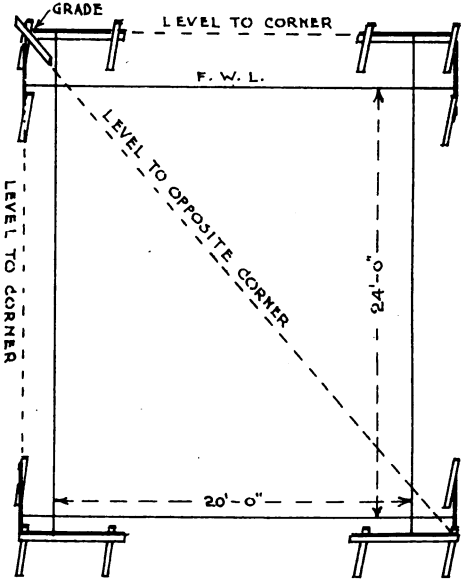

FIG. 4

leveled on the triangle stakes. From this corner level and sight to all other corners and mark the height of grade line, then nail the batter boards on the stakes at

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grade height around each corner and angle. Measure the length and width of intended structure on the batter boards and from these measurements draw a line on four sides (fig. 4), sight across to see that all lines are parallel; if they are not, relevel to all corners to find the one that is out of level and raise the same parallel with other lines. (fig. 4½.)

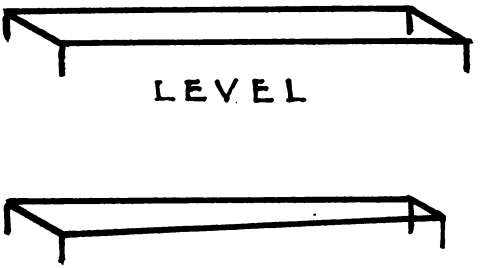

FIG. 4½

TO SQUARE A FOUNDATION

The front wall line, parallel to the street and leveled to grade, remains unchanged.

Rule 1. From the intersection of the lines at the established corners of the build-

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ing, measure 6′ on one line and 8′ on the intersecting line and adjust the side line so the hypotenuse, or measurement between 6′ and 8′ will be 10′ (fig. 5). With every ad-

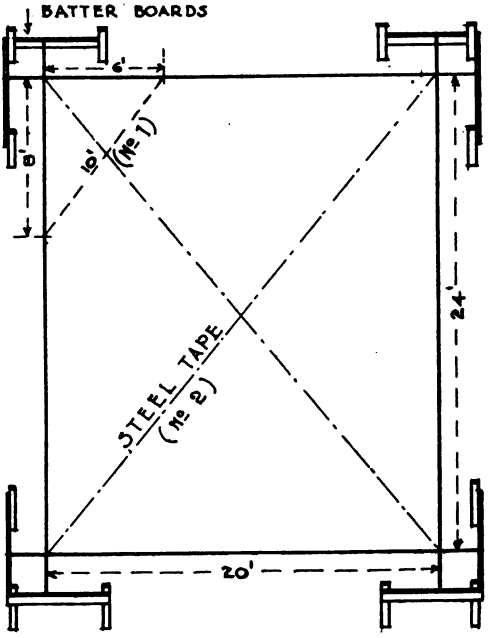

FIG. 5

TO SQUARE A FOUNDATION

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justment of the line, remeasure from the intersection of the two lines until the measurements are exactly 6′, 8′ and 10′ and the lines will be at a perfect right angle or square (fig. 5).

Rule 2. Take a steel tape-line and measure diagonally to the opposite corners, then reverse the tape-line to the two opposite corners, and adjust the lines until the measurements are the same and the lines will be squared.

This rule is reliable in any building where the measurements are taken equal distances on the side lines from the two front corners and both ends of line are the same width.

TO EXCAVATE A BASEMENT

From the lines that have been leveled and squared to the grade, plumb down for the excavation.

Cut a stake the length of intended depth of the basement from the grade line to the basement floor—allowing for the thickness of cement floor, excavate the depth of this stake from the grade line. All measurements for depth of basements, walls, piers, footings, etc., are taken from the grade line.

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Leave an approach at one end to draw out the ground. When all dirt is removed except the approach, draw the line in place, plumb down, and excavate the balance with a shovel. Where the bank is to be used for the outside form of a concrete wall, excavate plumb with the wall lines, but where forms are used on both sides, the depth of the wall, excavate the outside of the wall lines 8″ to 1′ to admit the forms.

FORMS FOR BASEMENT WALLS

All bearing walls should have footings sufficient in width and depth to carry the weight of the building (see fig. 7), excavate and put in the footings before setting forms for the walls. The forms for a concrete wall are commonly made of board moulds. There are different ways in which these forms may be built. We will give one of the most practical ways for a basement wall. This method will work for any wall.

Cut 2x4's the length required for partition studs of the building and use them for the upright supports of the basement wall. Plumb down from the grade or wall line at the corners and drive a stake directly

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under the top wall lines. From these stakes draw a line to set the bottom of the forms plumb with the top line, cut enough sheeting boards of equal length to make a section of forms from the bottom of the basement to the top of the wall; set the corner studding the thickness of the sheeting outside of the wall line; stake and nail the bottom and brace the top two ways to keep the corners plumb. Nail a board flush with this studding on the inside at the bottom, and set another studding, centered on the end of this board, plumbed and braced at the top and staked at the bottom the same as the corner studding. Then nail another board of this section at the top temporarily on which to space and set the other studs of this section. The studs should be spaced not more than 2½′ apart. (See fig. 6a.)

From this section measure to the opposite corner and cut enough boards of this length to make another section to finish the outside of the wall. Space and set studs as in first section. Continue this method on each of the outside walls. Cut No. 11 wires long enough to span around the studs of the inside and outside forms; place one around

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each stud above the first board of the outside wall and about 2′ above this as the form is sheeted. When the inside form is placed and sheeted, they can be easily attained and tied. Cut 1″x1″ spreaders the

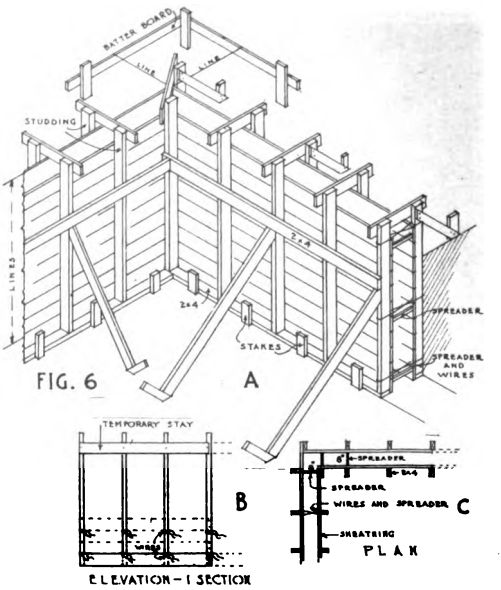

FIG. 6

length of desired thickness of the wall (fig. 6). Cut the boards for the inside sections, using the same method as for the outside,

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placing studding directly opposite the outside studding, except at the corners (fig. 6b).

Set the end of the first section in from the outside wall 7/8″ more than the length of the spreader to allow for sheeting of returning forms, then place another spreader between the two forms near the bottom of the form, loop the wire around the studs above the first board, tie and twist the wire to hold the spreader and form in place.

Nail temporary ties at the top to stay the inside form to the outside, the thickness of the wall, measure from this section to opposite corner allowing for thickness of wall and return sheeting the same as the first corner, keeping the wall of the same thickness. Cut enough boards of one length for this section and set the studs as before. Continue this method around the inside of the wall. Place a spreader between the forms at each stud, where the wires were placed, in the outside walls as the sheeting progresses. Draw them tight and tie on the edge of the studdings; with a bolt or spike twist the wires taut enough

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to hold the spreaders in place; continue this method until completed. Nail the boards with 6d nails, vice versa, every other stud. Continuing this process to the top of the wall, lay a 2x4 flat on the ground against the studdings and stake firmly to straighten the forms and hold them in place, also nail a 2x4 near the top of the form for the same purpose. Brace every other studding to hold form in place. Leave top wall line in place until all walls are straightened and braced. (See fig. 6.)

CONCRETE MIXTURE

For walls use 1 part of cement to 6 or 7 parts of coarse sand and gravel, depending on the sharpness of the sand. For concrete five parts of coarse sand and gravel for the floors and walks, take one part cement to base, 2 to 4″ thick; basement floors, 2″ thick; walks, 3½″ base; for the top or finish coat use one part cement to three parts of sifted sand; using ½ to ¾″ of this mixture. Apply the top while the base is moist so the top and bottom will unite. Straight edge and trowel to an even surface.

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Where there is no machine to mix concrete, clean a sufficient surface of hard ground, or lay a board floor where the ground is not suitable, close by the gravel and sand, then empty one or more sacks of cement conveniently close and to the number of shovels of sand or gravel for either of the above mixtures add one shovel full of cement and with a garden rake mix thoroughly. Continue this operation until a sufficient quantity is mixed, then reshovel and rake the pile again and you will have an even, dry mixture better than can be done with shovels alone and a greater quantity can be mixed at one time by this method. The cement will not set in a dry mixture. Moisten a portion of this by shoveling onto a separate pile and apply water sufficient to moisten to a proper consistency, mixing thoroughly and place in the floor or wall forms and continue this method until the work is complete. Where piers or footings are needed, locate them directly under the wall or supporting girder at the required distance apart, the height of which is determined from the grade line. (Fig. 7.)

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For concrete floors, level the ground to the proper grade, take 2 2x3's or 2x4's to gauge the thickness of the floor, place the concrete on the floor the height of the gauge, draw a straight edge across the top of the gauge to level to an even surface. Draw the timber forward for another fill, and straight edge, the same as before. Fill the space of the timber as it is removed. The same method is advisable for the top coat, take ½ or ¾ in strips and apply the top coat as described above. The surface should be leveled with a wooden float before trowling.

TO PLACE SILLS AND GIRDERS

When the wall is seasoned and forms removed, lay the sills on the wall, the dimensions of the intended structure leveled and bedded in mortar. Where a girder is required, double two to four thicknesses of 2″ plank, indimention, to the weight to be carried; chisel a bearing in the wall so the top of the girder will be level with the top of the sill, put posts of 6′x6′ or heavier, under the girder, 6′ to 8′ apart for ample support of the building. (Fig. 7.)

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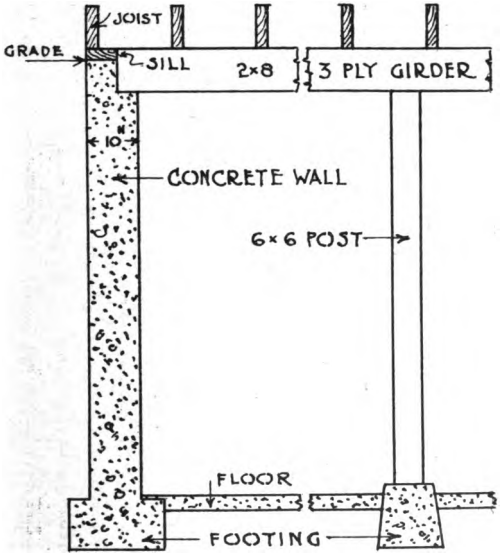

FIG. 7

SPACING AND PLACING JOISTS

To space the joists, measure and mark 15″ and 17″ from the corner on the sill and continue to space 16″ from these markings, set the joists between these lines and they will be 16″ on centers across the building.

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If there are two rows of joists and you wish to lap them in the center, space one side 2″ less in the first space so they will

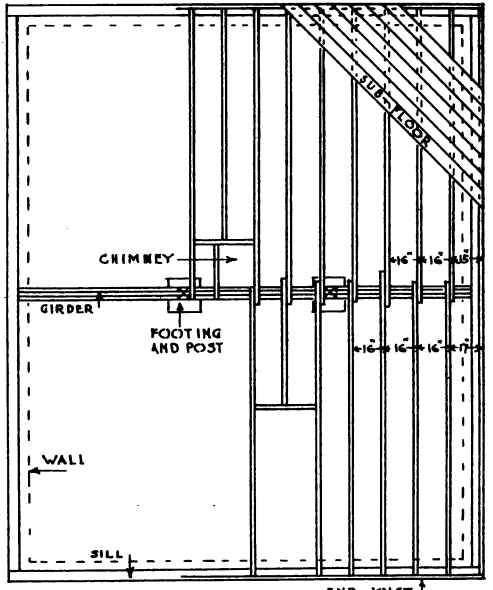

FIG. 8

run parallel. (Fig. 8.) Where a sub floor is used, place a joist or header across the ends of the joists for a bearing of the sub

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floor. Also a partition of rooms having no sub floors; bearings, or headers, should be cut and nailed in between joists to support sub floors at all openings.

Locate chimney, cellar and all other openings and trim them the required size. Where the span of the joists are more than 12′, cut a row of bridging and fasten them in place by nailing the top, leaving the bottom to be nailed after the sub floor is nailed in place. See that the crown of every joist is up. Where there is too much crown, straighten them so the top of all joists and bearings are level. (Fig. 8).

SUB FLOORS

In nearly all buildings it is best to lay the sub floors diagonally, so the finished floor can be laid to suit the room. Measure equal distances from the corners on both walls and place a floor board across to those points, lay the sub floor from this board, and the floor will be diagonal or 45 degrees. Trim the projecting edges even with the outside of the joists and flush with all openings, nail all boards with two 8d nails in each joist, placing the nail ¾″

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from the outer edge of the board. (See fig. 8.)

PLACING PLATES

Place and line 2x4 plates around the outer edge of the building, then measure and locate all partitions, marking them on the plate and sub floor with a chalk line. Line all partitions on the sub floor to lay the partition plates. To space the outside studdings, begin at the front, measure 15″ and 17″ from the corner for the spacing of the first studding, then continue 16″ from these markings, the studding will be 16″ center.

For all partitions space first studding 15″ and 17″ from intersecting wall and continue spacing at intervals of 16″ from these markings, the same as on the outside wall plates. This will locate studdings with 16″ centers for lathing. Place the studding directly over the joists for bearing partitions where possible. Locate all door and window openings and mark them on the plate, then make a duplicate plate for the top, laid beside the bottom plate, and mark the same spacings as for the bot-

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tom plate, and the studs will be parallel to each other. Double the top plate after the studs have been put in place and raised. Lap joints at the corners and partitions with the top plate. (Fig. 9.)

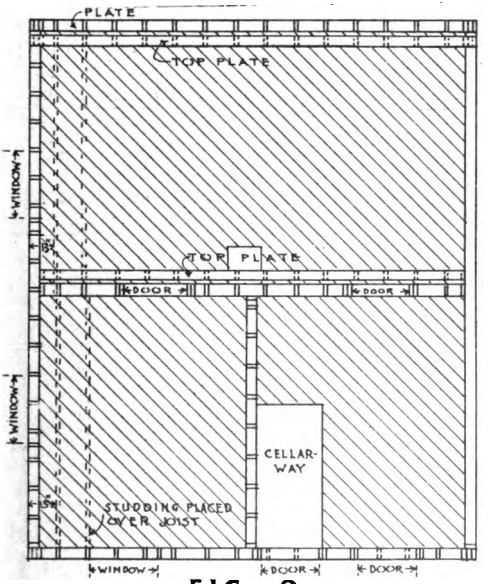

FIG. 9

TO CUT AND PLACE STUDDINGS

From the desired height of ceiling, de-

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duct the thickness of the plates for the length of the studding. After this has been done and a pattern made, nail a small block to one end allowing it to extend one inch over the sides, this studding is to be used as a gauge to mark and cut duplicate studdings. (Fig. 10.)

FIG. 10

All corners should be doubled or trippled. (Fig. 11.) When the spacing is complete

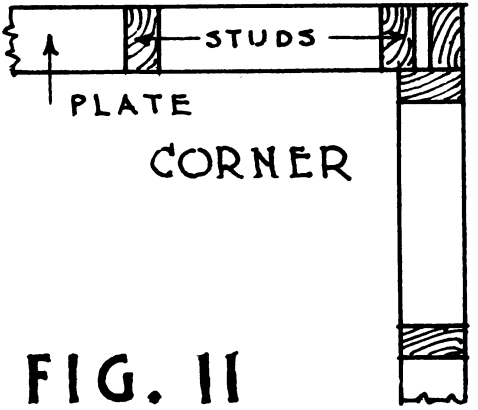

FIG. 11

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and studs are cut, nail them on the top plates in their respective places, trim all openings, then raise the section and nail the studs to the lower plate. (Fig. 12.)

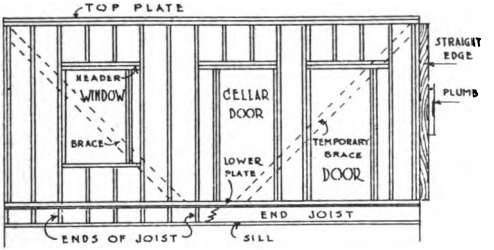

FIG. 12

Where there is a ribbon used for the support of the upper joists, measure down the thickness of the joist and notch in the stud the thickness and width of the ribbon below the joist for a bearing, using a 1x4 for the ribbon.

TO TRIM OPENINGS

Cut a gauge stake two inches longer than the height of doors, plus the thickness of the finish floor, and mark on the studding for the bottom of the top trimmer for door and window openings. For all window openings, measure down from the top

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header 5″ more than the height of sash for the top of the bottom trimmer. The allowance for the head jamb and sill.

All top trimmers should be doubled, the side trimmers for doors, sash and casement windows, add 3½″ to the width of the sash or door for side jambs. For a double hung or weight window, add 6″ to the width of sash for jambs and pockets. For a mullion (two windows side by side) allow 5½″ more for mullion between windows for weight pockets and jambs. For sash or casement, mullions where there are no weights, allow the width you wish for the mullion casing. (Fig. 12.)

In bearing partitions and walls, truss across the openings. All door sash and casements should be doubled on the side, set the full stud on the outside and double under the top header.

TO PLUMB A BUILDING

When all walls and partitions have been raised and fastened in place, nail a temporary brace board at the top to each corner, extending diagonally to the bottom plate. With a straight edge and plumb

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plumb each corner and angle, fasten the bottom end of the brace board to keep the frame plumb until the walls are sheathed, or permanent braces are cut between the studs. See that all plates are straight before placing upper joists. (Fig. 12.)

OUTSIDE WALL SHEATHING

In most countries the outside is sheathed before a finish siding is put on. Begin at the bottom of the sill and sheath up. Cut all door sheathing flush with sash and casement window openings. For double hung or weight windows, let the sheathing boards extend 2″ in the opening to form a pocket for the weights. Put two 8d nails in the boards at each studding. Trim all corners flush. Keep all openings and corners trimmed as you sheath.

NAMES OF RAFTERS

There are different kinds of rafters, viz: Common, Jack, Cripple, Hip and Valley (see Fig. 13). A common rafter extends from the plate to the ridge. A Jack rafter extends from the plate to intersection of the hip. A cripple rafter extends from the valley to hip or ridge. A hip rafter ex-

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tends from the corner of the plate to the ridge diagonally. A valley rafter extends from the intersection of two roofs at right angle to the ridge and runs parallel with the hip rafter. (See fig. 13.)

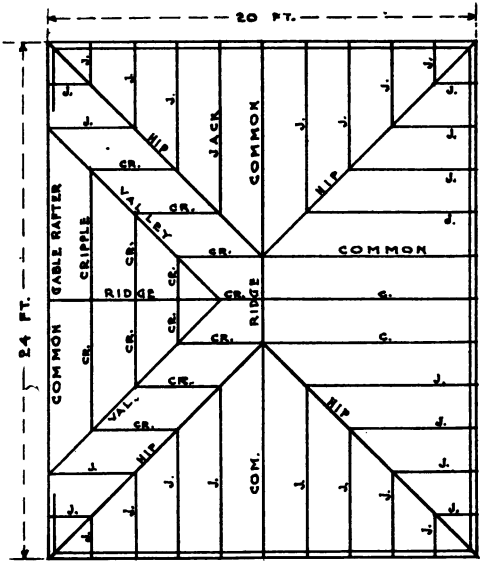

FIG. 13

BASE, RISE AND HYPOTENUSE

There are three lines on the square with

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which all cuts are obtained. The base, rise and hypotenuse (the angular line from base to rise), (see fig. 14). It is important to

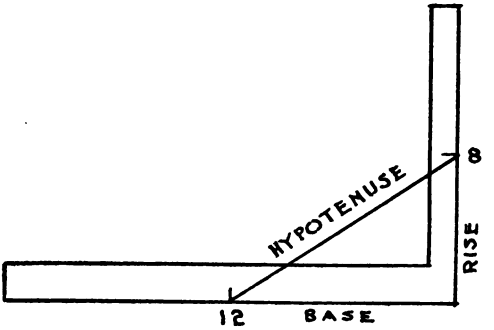

FIG. 14

understand their relative uses in framing. Study the rules and demonstrations herein given. The base represents the horizontal line and is reckoned in feet. Every horizontal line represents one base foot in framing. Twelve inches is the base of the square for common, jack and cripple rafters, brace, truss, bracket, bridging, house and barn framing, and nearly all framing at right angles; the 12″ base does not change on the square for obtaining the

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pitch of roof, angle of brace and various cuts, as the rise. (See fig. 15.)

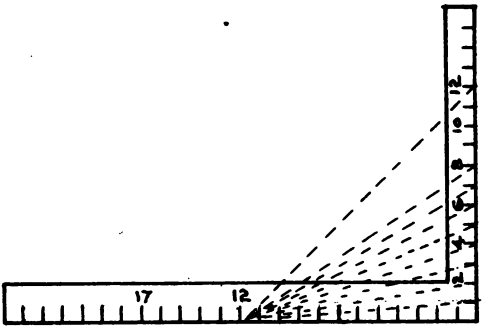

FIG. 15

The base of a hip or valley rafter is 17″. The diagonal, or hypotenuse of a 12″ square is nearly 17″. Every foot on the plate represents one base foot of 17″ for a hip and valley rafter (see fig. 16). This base does not change in obtaining the different pitches of roof (see fig. 17). Then a 17″ base with the same rise used in the 12″ base will meet at the same point on the hips after. (See fig. 18.)

The Rise is the perpendicular line, and is

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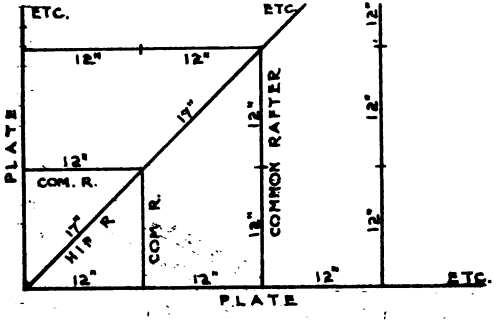

FIG. 16

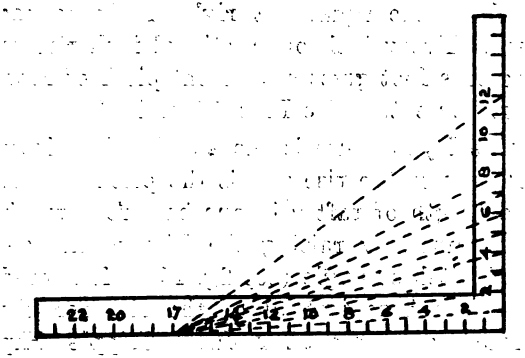

FIG. 17

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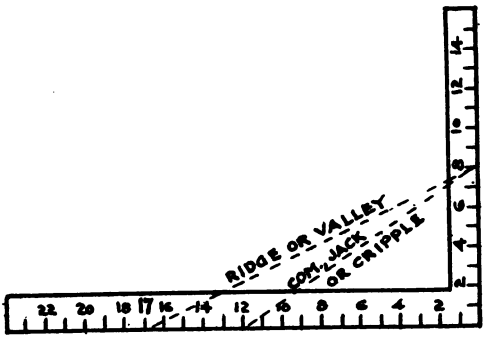

FIG. 18

used on the square at right angle to the base. Every inch or fractional inch rise to one base foot gives a different pitch of roof, angle or cut. (See Figs. 15 and 17.)

The Hypotenuse is the angular line from the base to the rise and is the pitch of roof and length of rafter in one base foot which is obtained by raising the Rise to the desired pitch or angle (see fig. 15). It is used with the base instead of the rise for the angular or face cut for Jack, Cripple, Hip and Valley rafters that meet the ridge, Hip and Valley rafters, which will be explained.

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The base of an Octagon is 13″, used with the same Rise of the common rafter, to meet the same point. The difference of the radius and the distance to the corner of the octagon is 1″ to every radius foot. (See fig. 19.)

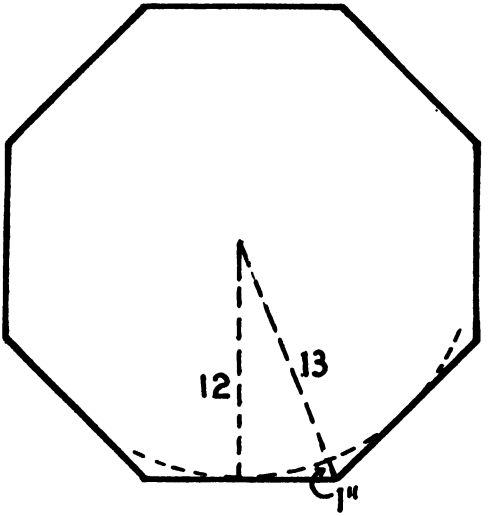

FIG. 19.

We will use repetitions of many of the

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rules here given. If the Mechanic or Student does not understand them in one form, they may comprehend them in another.

TO FIND THE BASE FEET IN A RAFTER

To find the number of base feet of a rafter is absolutely necessary in framing a roof. The base of a rafter is the number

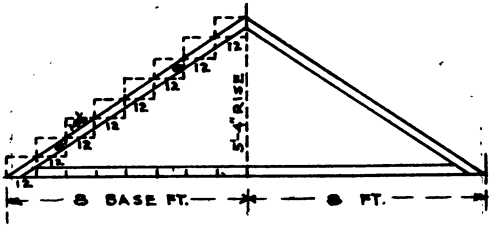

FIG. 20

of horizontal feet to be spanned by the rafter. (See fig. 21.) It is advisable to draw the dimensions of the roof at ¼" scale, and mark the rafters in, as shown in fig. 13.

BASE FEET OF COMMON RAFTERS

There are as many base feet in a common rafter of a Hip roof as there are number of feet in one-half the width of the building. (See fig. 21.) There are as many

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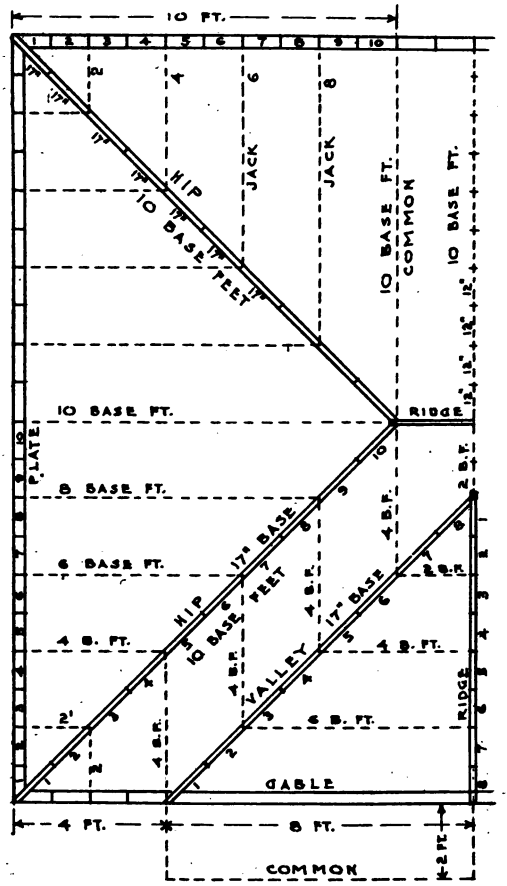

FIG. 21

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base feet in a common rafter of a gable roof as there are number of feet in half the width of the gable. (See fig. 22.) Or,

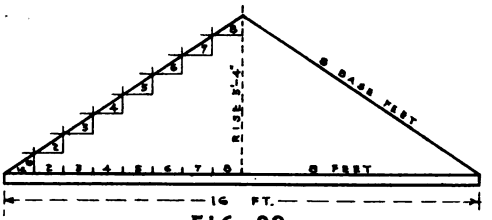

FIG. 22

there are as many horizontal feet from the plate to a perpendicular line of the ridge with any Rise to obtain the required pitch.

BASE FEET OF JACK RAFTER

There are as many base feet in a Jack rafter as there are number of feet on the plate from the corner to the center of the rafter. (See fig. 21.)

BASE FEET OF CRIPPLE RAFTER

There are as many base feet in a cripple rafter that extends from the valley to the hip as there are number of feet on the plate from the corner at the hip rafter to the center of the valley rafter, or from corner to angle. (See fig. 21.) The base

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of a cripple rafter that extends from the valley to the ridge of a gable roof is the number of feet on the ridge from the intersection of the valley and ridge. The rafters are set out on the ridge, 2′, 4′ and 6′, and have respective base feet. (See fig. 21.)

BASE FEET OF HIP RAFTER

Rule 1. There are as many base feet of 17″ in a hip rafter as the number of feet in half the width of the building. (See fig. 21.)

Rule 2. In cases where the hip does not extend to the ridge, there are as many base feet in the hip rafter as there are feet on th plate at right angles to a plumb line of the intersection of the hip rafter.

BASE FEET OF VALLEY RAFTER

There are as many base feet of 17″ in a valley rafter as there are number of feet in half the width of the gable, or the number of feet at right angles from the plate to a perpendicular line of the ridge. (See fig. 21.)

HEIGHT OF RIDGE

When there is a number of inches rise

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given to one base foot, the height of ridge is equal to the given rise as many times as there are base feet in the rafter. Add the height of the heel of the rafters in line with the outside of the plate. (See fig. 22.) When a certain height of ridge is given the number of inches rise to one base foot is equal to the height, reduced to inches, divided by the number of base feet in the rafter. The height of ridge, 5′ 4″, the number of base feet, 8. 5′ 4″=64″ ÷ by 8, the number of base feet, gives 8″ rise to one base foot.

TO FIND THE LENGTH OF RIDGE

For a hip roof the length of ridge is equal to the difference between the width and length of the building. (See fig. 23.) For a gable roof that intersects a main roof, the length of ridge is equal to half the width of the gable, plus any projection of building from main building. (See fig. 23.) The dotted lines represent an offset of 4′, the ridge in line of plate is 8′, making a total length of the ridge 12′.

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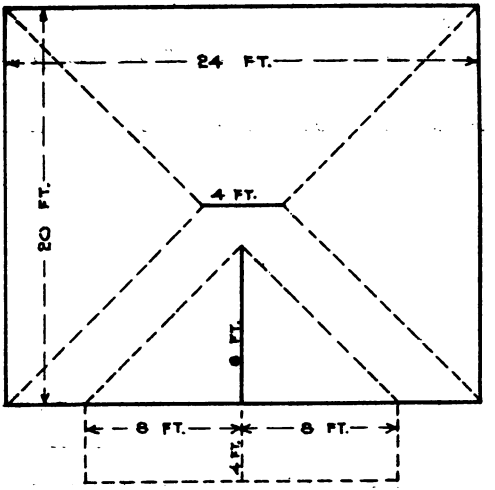

FIG. 23

PITCHES OF ROOF

Use the 2′ square to determine the number of inches rise and pitch.

½ Pitch is ½ of 24″ or 12″ rise to 12″ base.

1/3 Pitch is 1/3 of 24″ or 8″ rise to 12″ base.

¼ Pitch is ¼ of 24″ or 6″ rise to 12″ base.

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1/6 Pitch is 1/6 of 24″ or 4″ rise to 12″ base.

⅛ Pitch is ⅛ of 24″ or 3″ rise to 12″ base.

(See fig. 24.) Or take ½, 1/3 or ¼ of the

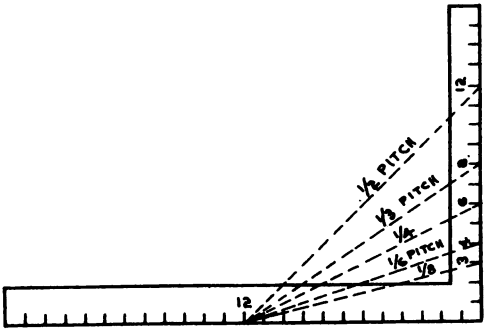

FIG. 24

width of the building for the pitch of the roof.

FENCE AND GAUGE FOR THE SQUARE

For rafter and stair framing, it is advisable to use a square gauge. It simplifies the uses of the square by fastening the gauge at the base and rise for the desired pitch. (See figs. 25 and 26.) A gauge or fence is easily made by taking a 1″x2″x2′

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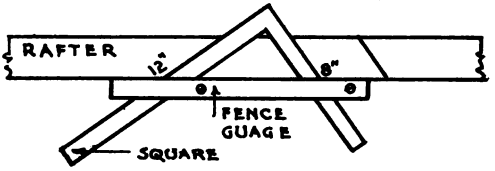

FIG. 25

piece of wood, rip edgewise 18", and with a couple of screws, clamp the square at 12" base and the desired rise, then lay the

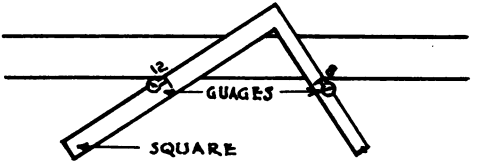

FIG. 26

gauge on the edge of the rafter, mark for rise, and check mark at base; move the rise to the check mark and recheck as many times as there are base feet in the rafter. (See fig. 27.)

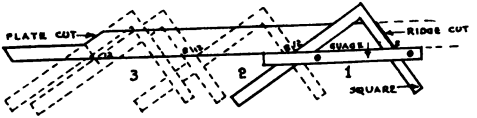

FIG. 27

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Where there is a fraction of a base foot, take the number of inches on the base at right angle, and move the square the fractional foot, 6″, and mark as in former directions. (See fig. 28.)

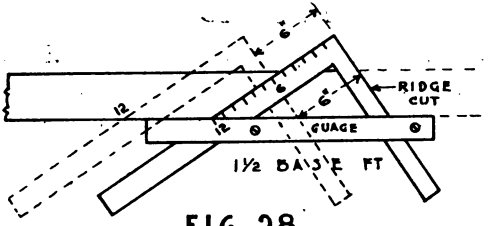

FIG. 28

THE SQUARE

It is important to understand the use of the square. The base, rise and hypotenuse of the square used in the different methods herein given solve the practical use of the square. Every inch to 8″ rise, with 12″ base, gives 8 different cuts on either of the three lines, and 8 different pitches of roof. It also gives eight cuts for braces, brackets, bridging and truss framing. In roof framing, the hypotenuse is the pitch of the roof and the length of the rafter in one base foot. (See fig. 29.) Any cut in framing

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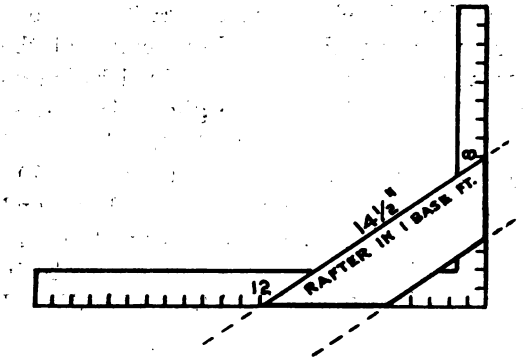

FIG. 29

may be obtained with 12″ base and the required number of inches rise. There may be a hundred or more different rises from the base and every one is a square root, or geometrical problem, but can be worked out with the square in a practical way without the knowledge of either square root or geometry.

COMMON RAFTER

There are as many base feet in a common rafter as there are feet in half the width of the gable, or half the width of the building in a hip roof. (See fig. 21.)

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The length of a common rafter in one base foot is equal to the hypotenuse of the base and rise and can be obtained by measuring from the base to the given rise. (See fig. 29.) This is true with 12″ base and any number of inches rise. (See fig. 15.)

Then lay the square at 12″ base and the given rise as many successive times as there are base feet in the rafter to obtain the length of the rafter. (See figs. 30 and

FIG. 30

32.) Mark on the base for the plate cut and on the rise for the ridge out. (See figs. 29, 30 and 32.) Where there is a ridge board used shorten the rafter half the thickness of the ridge. For an extension of the rafter over the plate for eave, and two or more inches left on the rafter for support, measure down perpendicularly from the spacing for the plate mark to the bottom of the rafter. Draw a line parallel with the rafter, 2″ from the top edge. Set the

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square to where the two lines intersect, use the base for the plate cut, and the perpen-

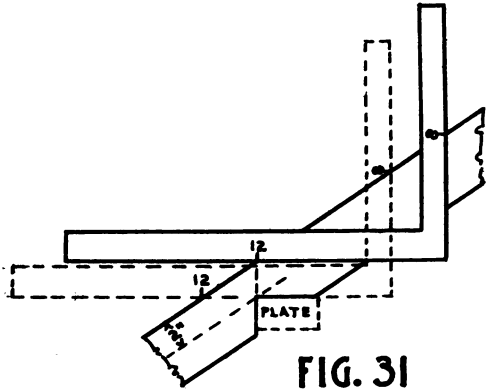

FIG. 31

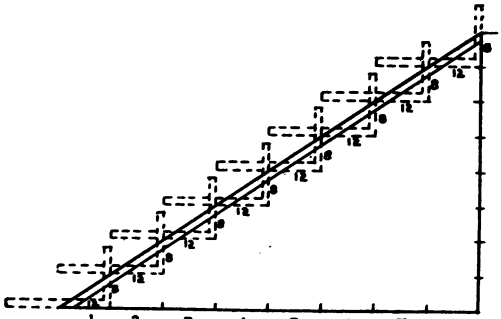

FIG. 32

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dicular line, down, for the outside cut of the plate. (See fig. 31.) The distance marked down from the top edge of the rafter does not change the length of the rafter. The top has the same angle, but raises the rafter and ridge the height of the thickness of the heel or support in outer line of plate. (See fig. 31.)

THE JACK RAFTER

There are as many base feet in a Jack rafter as there are number of feet on the plate from the corner to the center of the rafter. (See fig. 21.) The base 12″ and the same rise used in the common rafter laid on the rafter as many successive times as there are base feet to meet the hip rafter, gives the length of the Jack rafter. (See fig. 30.) Mark on the base for the plate cut, and on the rise for the perpendicular cut to meet the hip rafter. (See fig. 35.) Where a heel or support is let on see fig. 31.

The face or angular cut to meet the hip varies with the pitch and every 1″ rise. To obtain the angular cut to meet the hip, take the number of inches in the hypotenuse

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or the length of rafter in one base foot of the common rafter. (See fig. 33.)

Taking the length of the hypotenuse

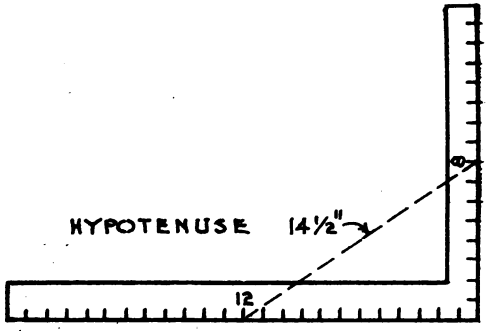

FIG. 33

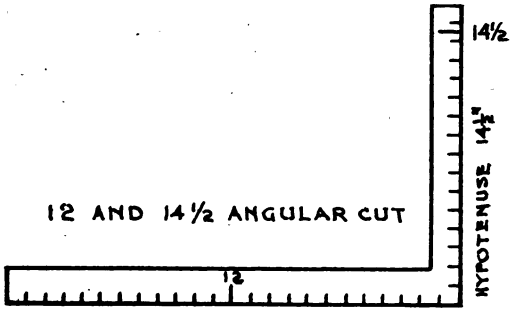

FIG. 34

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(14½″) with the base (12″) on the square instead of the rise (see fig. 34), and mark back on the length of the hypotenuse 14½″

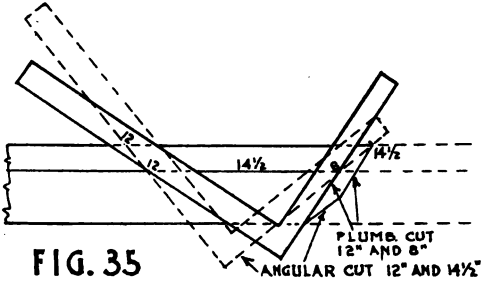

FIG. 35

for the angular cut. (See fig. 35.) This rule is reliable in any pitch of roof.

CRIPPLE RAFTERS

There are as many base feet in a cripple rafter as there are number of feet on the plate from the corner of the hip to the corner or center of the valley rafter. (See rules for base, fig. 21.)

To obtain the length of a cripple rafter, lay the square on the rafter at the base and rise of the common rafter as many successive times as there are base feet in the rafter. (See figs. 30 and 32.) Mark on

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the rise for the hip and valley cuts. To obtain the face cut to meet the hip rafter, use the same rule given for the jack rafter that meets the hip. (See fig. 35.) For the lower cut of the cripple rafter to meet the valley use the same rule as for the face cut to meet the hip, only reverse the angular cut by marking across the rafter, and cut parallel to the hip cut. (See fig. 36.)

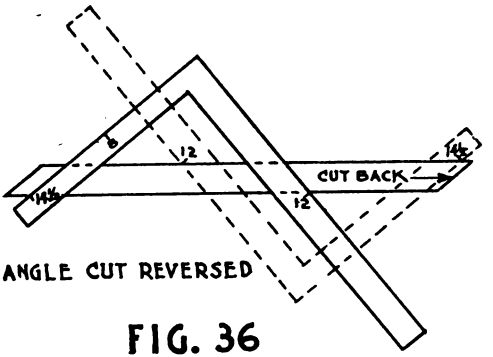

FIG. 36

HIP RAFTER

There are as many base feet of 17″ as there are number of feet in half the width of the building. (See rules for base of rafters, fig. 21.) To obtain the length of a hip rafter, lay the square on the rafter at

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17″ base and the rise of the common rafter as many successive times as there are base feet in the hip rafter. (Fig. 37.) Mark on

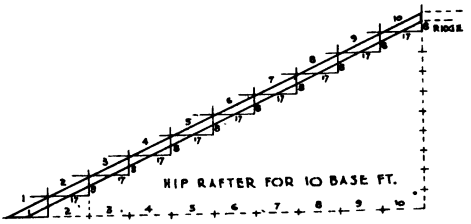

FIG. 37

the base for the plate cut and on the rise for the plumb cut to meet the ridge. (Fig. 40.) For the angular cut to meet the ridge,

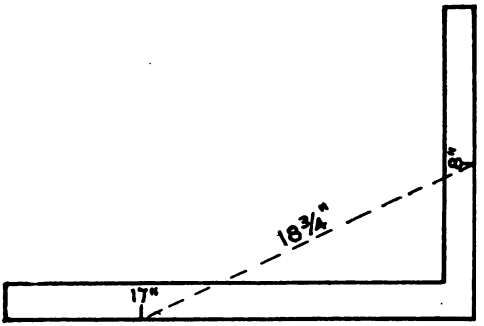

FIG. 38

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take the number of inches in the hypotenuse of the base and rise of the hip rafter in one base foot (fig. 38), using this hypotenuse to mark on instead of the rise (fig. 39), with the

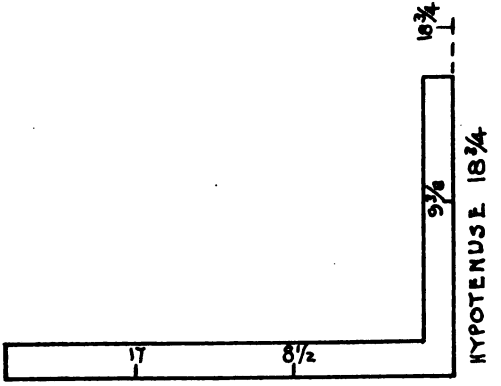

FIG. 39

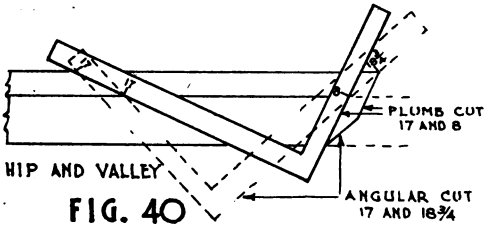

FIG. 40

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base (17″) on the square and mark on the length of the hypotenuse for the angular cut. (Fig. 40.) Take ½ of the base and hypotenuse where required.

This rule is reliable in any pitch. At the base of the hip rafter cut off ⅜″ to lower the corners to line of comon and jack rafters, or saw ¾″ or more, depending on pitch of roof, plumb down across the corner. (See fig. 41.)

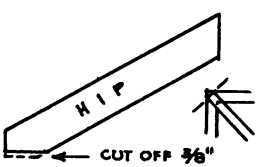

FIG. 41

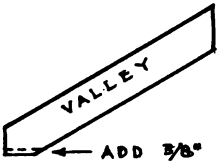

FIG. 42

VALLEY RAFTERS

There are as many base feet in a valley rafter as there are number of feet in ½ the width of the gable. (Fig. 21.) To obtain the length of a valley rafter, lay the square on the rafter at 17″ base and the rise of the common rafter, as many successive times as there are base feet to be spanned. (Fig. 37.) Mark on the base for the plate

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cut and on the rise for the perpendicular cut to meet the ridge.

The angular cut, to meet the ridge, is the same rule given for the hip rafter. (Fig. 40.) Mark 3/8" lower than the base mark for the base cut to raise the center of the rafter to line with common rafters. (See fig. 42.)

TO SHEATH A ROOF

Line the bottom board with the face of the rafters. It is rulable to space them 2" to 4" apart and continue this method until sheeting is completed. At the gable ends of the building, let the sheeting extend over the rafters the desired width of the plancier or eave.

To cut sheething boards to meet the hip or valley, take the hypotenuse of the base

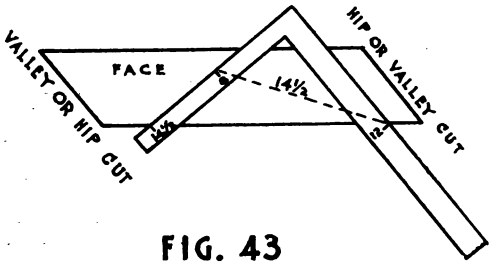

FIG. 43

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and rise of the common rafter with the base, and mark on the base for the hip and valley cut. (Fig. 43.) For the plumb cut of the sheeting boards for a hip and valley, take the length of the hypotenuse of the base 17″ and rise of the hip rafter with the rise and mark on the rise for the plumb cut. (Fig. 44.)

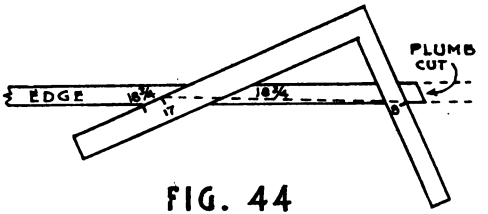

FIG. 44

The rules for cutting sheeting in valleys is used to cut eave and plancier boards that meet in an angle.

OUTSIDE FINISH

The outside finish consists of facier, plancier, frieze, corner, base boards and moulds. The facier board is the finish around the outer edge of the roof. (Fig. 45.) The plancier board is the finish from the facier to the building. The frieze is the finish on the wall under the plancier and laps over

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the siding. The corner boards are the finish around the corners. The base board extends around the bottom of the building, with a drip cap placed on the top edge on

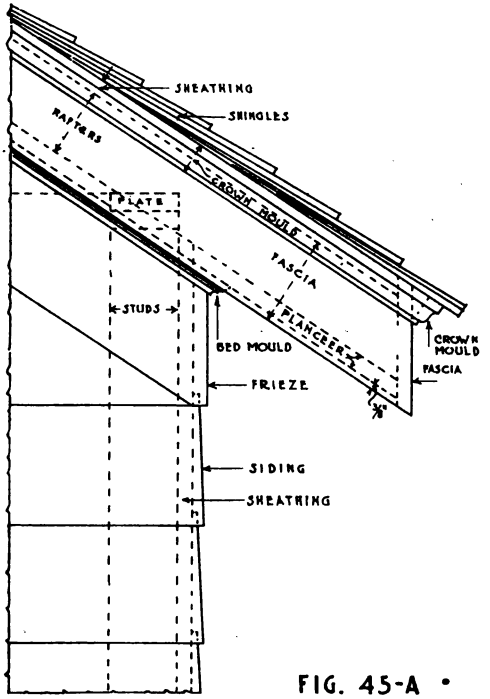

FIG. 45-A

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which to start the siding. The crown mould extends around the outside of facier. The bed mould is placed in the angle of the frieze and plancier.

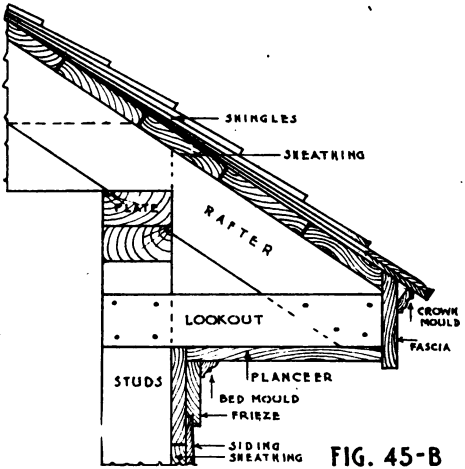

FIG. 45-B

Line up and saw the heels of the rafters for the facier board and let the facier extend above the rafters enough to receive the sheeting, and extend 3/8" below the plancier. Nail a block under the sheeting of the gable to lower the plancier for a 3/8" margin on the facier for rake or box cornice. (Fig. 45.)

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A box cornice returns square from the facier to the building, the plancier is supported with a lookout, nailed to the rafter and back to the wall. (Fig. 45b.)

Rabbit the frieze board or furrow it out to lap on the siding. Put a bed mould in the angle of the plancier and frieze. The style in fig. 45b is called a box cornice.

There are different styles of cornice, but we will not go into details of all the styles, but will only refer to some of them. Some ceil the plancier under the rafter and break square around the corner for the gable plancier. This style is called "Rake Cornice." Some ceil on top of the rafters with 13/16" ceiling instead of sheathing for the finish, allowing the rafters to be exposed. At the gable let the ceiling or sheeting extend from the rafter to the facier, breaking joints on the first and second rafters. Place the corner and frieze boards on the sheathing when lap siding is used. Where rustic siding is used place the corners and frieze boards over the rustic. Where a base board and drip cap is used, place them on before the corner boards and siding.

Paper all outside walls before siding, and

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place strips of paper under the finish that will extend for a lap of the wall paper.

TO SHINGLE A ROOF

Nail a shingle at each end of eave to be shingled and let them extend 1½″ or the desired distance over the sheeting for the drip. Put a shingle nail in the end of the shingles and draw a line taut across the eaves. Then lay a double row of shingles to this line, being careful not to allow the shingles to move the string out of line. Leave about 1/16″ between line and shingles to prevent this.

Measure up from the lower edge of shingles 4½″ or 5″, according to pitch of roof, for second row, and strike a chalk line for 3 rows. Shingle and continue this method until roof is covered (fig. 45), putting two nails ⅝″ from the edge in a shingle. You may use a straight edge to lay the shingles by, moving it up for each row. An expert shingler usually uses a gauge on his shingle hatchet, and lines with chalk and line every sixth row instead of using the straight edge or former method. Let shingles project

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over the gable facier or mould 13/16″ of an inch.

To cut a valley shingle to fit the valley or hip, take the hypotenuse of the base and rise of the common rafter with the base, 12″, and mark on the length of the hypotenuse. (Fig. 35.) This rule is reliable for hip or valley shingles. The end of the shingle cut from the valley will make a hip shingle. Do not have two cracks directly over each other. Keep them 1½″ apart for a good roof.

Chalk line the valleys to lay the shingles in line, leaving 2½″ valley between the shingles. It is advisable to have the top of valley ½″ narrower than the bottom. The valley tin 14″ wide, laps over and down.

To estimate the number of shingles for a roof, take the length of rafters and the projection of the gable and find the number of square feet in the roof. For 4½″ to the weather it will take 9 shingles to the square foot; then 9 times the number of square feet is the number of shingles required, and other widths in proportion.

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DOOR AND WINDOW FRAMES

Most frames are made at the planing mills, but when it is more convenient to build them, the following suggestions will be helpful. For a door or window, rabbet across the side jambs ⅜″ for the head jamb and sill. Cut the head jamb and sill ¾″ longer than the width of sash or door, for the gain or rabbet in the jambs. (Fig. 46.)

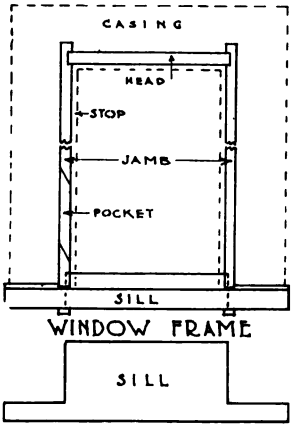

FIG. 46

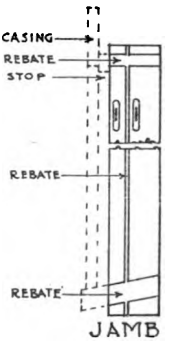

FIG. 47

The jamb must be made wide enough to extend ¾″ inside of the studding for the

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thickness of the lath and plaster. Let 2″ horns on the outside of sill to set the casing on, and for any projection desired. Casing to be soft wood. Add ½″ more to the length of the door frame than the height of the door. The window jamb should be plowed ½″ or ⅜″ for the parting stop, 2⅜″ from the outside of the jamb for 1⅜″ windows, and 13/16″ stop. Set the pulley down from the top 3½″. Cut a pocket 4″ from the bottom to a height of 10″ to 12″ to admit the weights.

Cut the pocket on a 60 degree angle and fasten with two screws at the bottom and one at the top. (See fig. 46.)

TO SET DOOR AND WINDOW FRAMES

Cut a pole ½″ longer than the height of the door, adding the thickness of the finished floor. Set the pole under the head jamb of the window for height of frame. Level and plumb the frame at this height and fasten in place.

PORCH

Line and nail a 2x4 on the joists or sheething the thickness of the porch flooring lower than the door sill, the length of

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the porch, less the thickness of the headers. Cut the headers the length of the width of the porch, nail and square to the 2x4 nailed on the wall joists. Measure the length of the joists between the headers, next to the wall, and place them the desired distance apart. (16 to 24″.) Make the frame 3″ shorter than the floor boards. Slope the frame to the front about 1″ to every 6′ for drain. Lay the floor two inches over the side of the frame. Line and cut the front the same as the sides to extend over the frame for facier board and cove. Locate the posts, deduct the depth of the beam from the height of the ceiling for the length of the posts, adding the drop of the porch floor.

Build the beam for the support of the porch roof that rests on top of the posts of 2″ plank or boards. Then place the joists for the ceiling 2′ or more apart the same way the floor joists run. (Fig. 48.)

The ceiling usually runs the same as the floor. Cut the rafters the desired pitch and style of roof, allowing for facier. Sheath and shingle same as main roof. Locate the height of the top rail; keep the

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bottom rail 2½″ from the floor and the side rails level, not following the slope of floor. Take the space between the rails for the length of spindle, and the distance between posts for the length of rail, making allowance for fitting. Ceil the ceiling of the porch and put a cove in the angles of the ceiling and under the outer edge of the floor, a crown mould around the facier, and a bed mould in the angle of plancier and frieze.

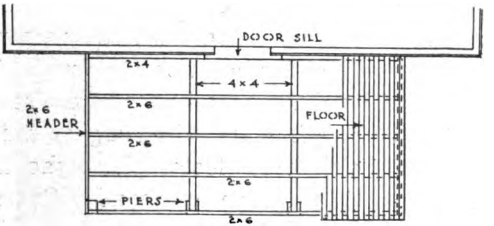

FIG. 48

LATHING

The lath should be spaced 5/16″ apart to admit the plaster for a good clinch, breaking joints every ninth lath. Put grounds around the inside door openings ¾″ thick by 1″ wide. Plumb and straight edge them and gauge them the same width

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in all door openings, or, when the lathing is done, nail a lath around the face of door openings, to gauge the thickness of plaster. Plumb, straighten, and gauge the same thickness as the width of the former grounds, ¾″ for lath and plaster.

FINISH FLOORS

Line and nail the first board perfectly straight. Lay and nail all other flooring tight. Where the flooring board does not extend the length of the room, have at least two boards, between each joint on the same joist. Blind nail pine flooring with 7d nails. For hard floor, use 6d casing nails, and for ⅜″ flooring use 4d casing or finish nails. To finish pine floors, plane the uneven edges, then scrape and sand. Cut all hard wood floors to an even surface with a cabinet or floor scraper, sandpaper lengthwise of the floor to a smooth finish with No. 1 and No. 0 sandpaper.

INSIDE FINISH

The inside finish consists of door jambs, casings, head trimmers, base, window stool, aprons, stops, picture mould, closet strips,

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doors, windows, etc. Scrape and sand out all defects and plane marks before putting finish in place. Straighten and gauge the door jambs the thickness of the partition or walls. Cut a gain $\frac{3}{8}''$ for the head jamb and cut the head jamb $\frac{3}{4}''$ longer than the width of the door for the gains. Measure down from the head jamb $\frac{1}{2}''$ more than the length of door. (Example—for a 6′ 6″ door, make the jamb 6′ $6\frac{1}{2}''$.) Square the jamb at this length and when put in place, keep it up the thickness of the finish floor. Fit the window stools between the jambs, leave 1/16″ between stool and sash. Let the inside projection of stool extend over the outer edge of the casing the distance between the front edge of the stool to the face of casing. Case the double hung windows flush with the jambs. Case doors or casement windows 5/16″ back from the edge of the jamb, around the opening. Dotted lines around the door (fig. 49) represent casing.

Cut the apron the length of the outer line of casing. Cope or mitre the ends and fit it under the stool in line with the casing.

Cut the approximate length of the base

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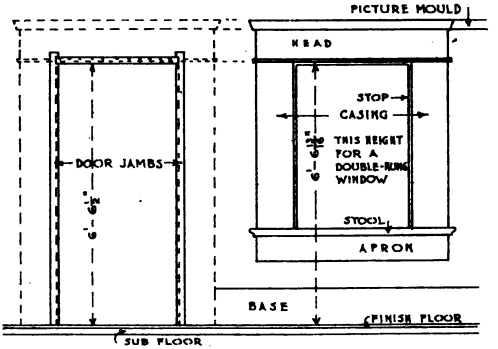

FIG. 49

boards for each room. When finished in the natural or stained, select the grain to match in each room. With spacing rods get the length of base board needed for each wall. Cope the corner and fit to casing or base blocks. Cut the door and window heads flush with the outside edge of the casing. When there is a fillet used, let the fillet extend over the outer edge of casing $\frac{3}{8}''$. To get the length of picture mould, use spacing rods, then cope the corners and place them $\frac{3}{8}''$ from the ceiling, or it may be placed in line with the top of window and door heads. The regulation

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height for closet strips is 5½′. For door stops, cut the head stop between the jamb and cope the side stops to the head stop and cut the bottom square to fit the floor. For window stops, use same method as for door stops, allowing 1/16″ between stop and sash.

Straighten and square the back edge of the door to be hinged, set it in the opening flush with the jamb on the hinged side. Mark the front and top flush with the jamb, then rip and plane to the line, beveled back 1/16″. When properly fitted, will have nearly 1/16″ space on top and sides of the door. Set the door in place and mark with a knife for the hinges 7″ from the top for the upper edge of the top hinge and 11″ from the floor for the bottom end of lower hinge. If there is a third hinge used, divide the space between the top and bottom hinges. It is practical to make a pole with those markings to have all door hinges set the same.

For sash and casement windows, fit the hinged side and bottom, then mark the front and top to jambs. For double-hung windows, fit. the top sash and put it in

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place, then plane off the sides of the bottom sash the proper width and set in place. Set a compass the width the top rail of the bottom sash extends above the rail of the top sash, and mark with the compass the bottom rail of the lower sash to fit the sill. Set a bevel square the angle of the sill, mark across, and rip on those lines.

CASES AND CUPBOARDS

Lay the outline of cupboard or case on the wall by marking height and where shelves are desired. These markings or heights can be made on a pole or gauge to get height where it is inconvenient to mark on the wall. Lay out the width and depth of cupboard on the floor. Space the width of doors, casings, drawers, crossbars, head, base, etc. Use casing the thickness of the cupboard doors. Cupboards should extend from the floor to the ceiling, making a short door at the top for a storage shelf. Dotted lines (fig. 50) represent shelves.

Make the draw fronts of 13/16″ boards, rabbet the end ⅜″ deep and the width of the sides of the draw, allowing for the front to lap over the opening ⅜″ to close the

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crack, then plow the sides and front 3/8" above the bottom, 3/8" wide for the draw bottom. (Fig. 50.)

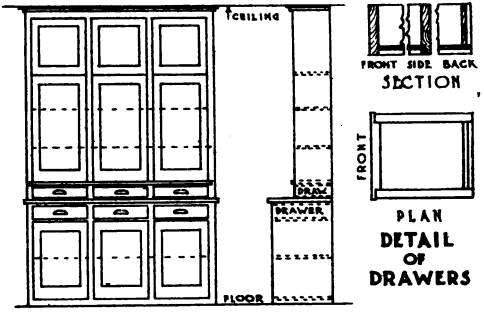

FIG. 50

STAIRS

Stair framing is figured by run and rise and is not computed by base feet, as in nearly all construction. The run of the step is the horizontal or tread line and the rise is the perpendicular or rise line. We must determine the number of treads and rises for the span of the stair. Cut a pole the length from the top of the finish floor below to the top of the finish floor above. With a compass space the desired number of rises in the stair. There is one less run

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than rise in laying out the stair. Plumb from the header above to the floor below.

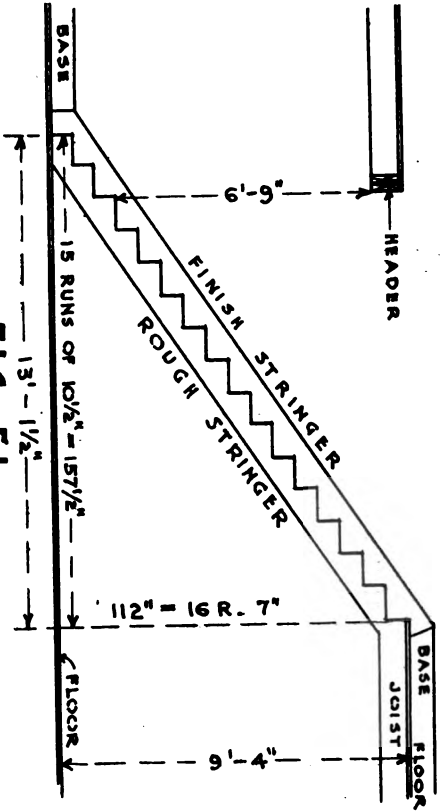

FIG. 51

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Allow 1¼″ for finish, and measure back the length of the run of one tread as many times as there are number of runs in the stair. (Fig. 51.)

Where there is a certain amount of space for the stair, divide the same with the compass for the number of runs required, one less than the number of risers.

The tread is 1¼″ wider than the run for nosing. The finish rise is the same width of the rise of the stringer. (Fig. 52.) Ex-

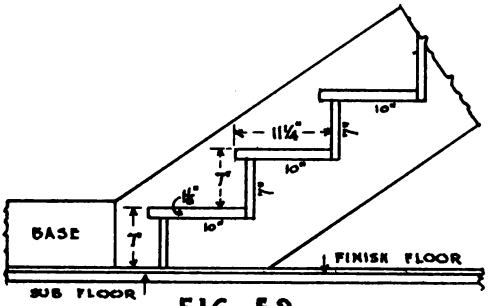

FIG. 52

ample: The height from finish floor below the top of finish floor above is 9′ 4″, or 112″. Keep as close to 7″ rise as possible, where there is room for the run. There are 16 rises, 112÷16=7″ rise.

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Where there is space, make the run 10″ for a 11¼″ tread. To locate the header of opening, find the number of runs and rises in the stair as described, and locate the first rise. The plumb line between the rear header and stair tread should be 6′ 8″ to 7′. The ceiling is 8′ 6″, the third riser is 21″ high, the distance between the third rise and ceiling is 6′ 9″. Plumb up from the third rise for the header of the opening. (See fig. 51.) Lay the square at 10″ run and 7″ rise on the stringer to be cut out, as many times as there are runs and rises in the stair. Cut off the bottom of the first rise the thickness of the finished tread. Nail this stair horse on the finish stringer 3″ from the top edge to the point of rise and run to support the rise and tread. Cut out of finish stringer at the top that rests on the floor, the thickness of the tread and cut the top and bottom of the finish stringer to meet the base with mitred joint. (Fig. 51.) Take the width of opening and deduct the thickness of stringers for the length of the tread, straighten and square a tread for a pattern to mark all other treads and rises, using a knife point to do all marking.

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Nail the risers and treads in firmly. If the one side is exposed, allow for an outside finish string. There are different methods to build stairs. The treads and risers may be housed in the finished stringer and wedged and glued. All stairs are figured on the method described, whether two or more risers and runs. Any one wishing to make a specialty of stairs work can obtain books especially for stairs.

GARAGE

Locate, stake and establish the grade. Then level, line and square as described in the fore part of the book. (See index for same.) Set the forms for the concrete wall, setting bolts in the concrete and let extend 2½″ above the wall to bolt sills in place.

The wall should be 2″ or more above the finished floor. Leave an opening in the cement floor 2′x5′, directly under the engine and transmission, fill the pit with sand to absorb all grease that may drop. When it becomes too oily shovel out and replace with clean sand, and there will be no pans and oily floors to clean.

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Lay the sills and space them for the studding. Cut plates the dimension of the building over the sills and space the same as sills. Lay out the door and window openings. Cut the studs 8′, less the thickness of the sill and the plate. Nail the studs on the plate, raise and nail to the sill.

Brace and plumb the corners, double the plates, and tie the building the way the rafters span. Put braces above on the plate diagonally near the corners, to keep the front end plumb. Double 2x6 and set edgewise across the front for ties and headers over the doors. Notch out to lower the top even with plate. Cut the rafters for the desired pitch. (See rules on rafters.) Board the sides and leave openings for door and windows. Sheath and shingle as described. (See rule for shingling.) Put on outside finish.

Place the door cleats across the opening for front doors. Notch the side to set the cleat back the thickness of door boards, so the doors will set flush with the casing. The casing to be set back on the siding ½″ for stop. Cut the boards the proper length

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and build the doors in place. Brace and hinge before opening them.

The dotted lines (fig. 53) represents ties and braces on the top plate.

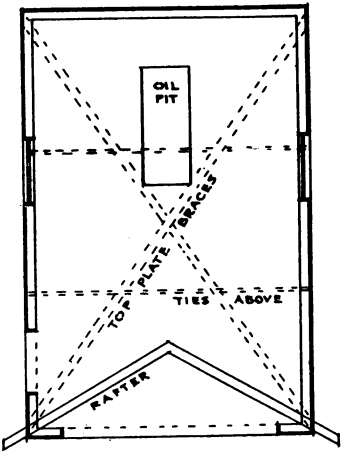

FIG. 53

CORN CRIB

The modern corn crib should be planned and constructed with the conveniences to conserve labor. Handling corn in ear or shelled will be no more the burden of the farm if properly planned.

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In the construction of this building you can locate, stake, find grade, level and square the building as described and illustrated in this book and with the rules for the use of the square, you can make any cut. (See rules covering same.) The dimensions of the crib is 28′x40′. The walls are 8″ thick and 12″ above the driveway floor. Concave the top of the wall to anchor the floor slab. The footings and wall to extend in the ground 18″, and at both ends of the driveway put footings 18″ deep to prevent rats from burrowing under the floors. (See fig. 54.) The floor slab for the cribs are 6″ thick, crowned in the center 2″ and extend over the wall 1″ for drip. Place iron sockets in the concrete slab, when poured, 2′ on center lined and leveled for the support of the studdings. The cement floor for the driveway is 5″ thick and should be mixed. Five shovels of sand to 1 shovel of cement for solid floor. The dimension lumber for building, outside studs, 2″x6″x14′. Inside studs 2″x8″x14′, double plate, with same dimension; 2″x8″ ties under the plates every 4′. Nailed to the studs and plates. Cross joists for bin 2″x8″ every 2′, ties under bin

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2″x8″ every 2′. Ties and cross ties in crib 1″x8″. The studs above the inside plates 2″x6″. Perline plates 2″x6″. Rafters 2″x6″. 16′ bin at both ends, leaving 8′ opening above between the bins in center for elevator. Board the bottom and side of the bin with matched flooring. Sheet and shingle (see rule for same). Use bats and drop siding for the outside wall. Matched flooring for doors. Board off a space 6′ wide the width of crib and 7′ high for engine room. Put

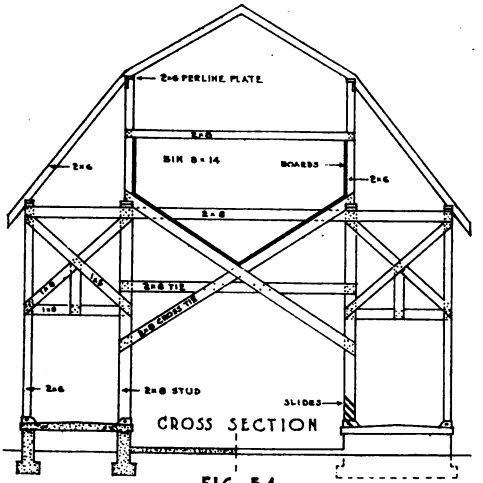

FIG. 54

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slides along the length of the crib to let the corn out for shelling. Set sheller by the elevator, to elevate the corn to the bins from the sheller. Begin in the fore part of this book and demonstrate every rule and diagram. This will enable you to make any cut required for this building. (Fig. 54.)

HEN HOUSE

Poultry raising is one of the commercial pursuits of the day. The care and shelter of the hen is absolutely necessary.

The hen house herein described is 12′x16′.

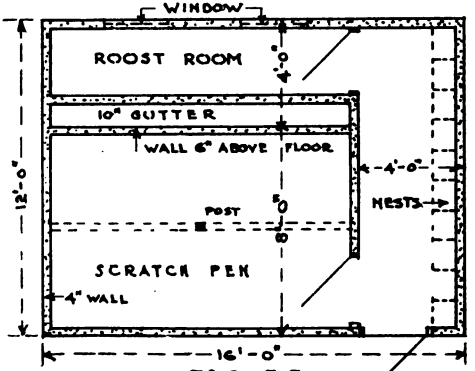

FIG. 55

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The foundation to extend 12″ above the ground and 12″ below the surface, to prevent vermin burrowing under the floor. Concrete the floor several inches above the surrounding grounds, for a dry floor. Run a 4″ wall 6″ high 8′x12′ for the scratch room. The nest room 4′x12′. The roost room floor 4′x12′ and has a gutter 10″ wide at the bottom of the drain. (See floor plan fig. 55.) The roosts extend over part of the scratch pen and conserves floor space, and is more easily kept warm in cold climates. Put 2″ to 4″ of sand or dirt on the cement floor in the scratch room. Hens should not sit on concrete when housed.

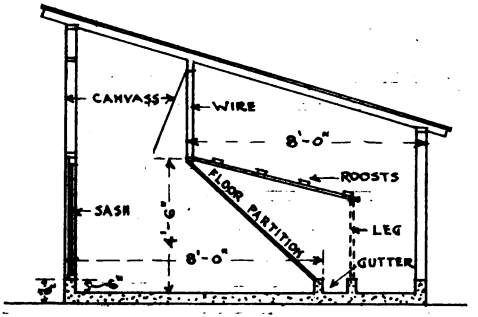

FIG. 56

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The dirt may be changed as often as necessary to keep sanitary. (See fig. 56.)

The partition between nest room and other rooms to be boarded tight. Cut doors in as shown. The partition between scratch room and roost room to be boarded tight except a 3x10′ opening 1′ above the roosts. This opening to be covered with mesh wire and have a canvass roll to close and open. The sloped partition under the roosts to gutter to be boarded upright with matched floor. The roost frame made of 1″x4″ with cross-bars every 4′. Hinges on back, roost strips 1″x2″. The nests 14″ wide and 12″ deep. Hinge the bottom of the nest box to drop and the top to raise to clean out and scrub.

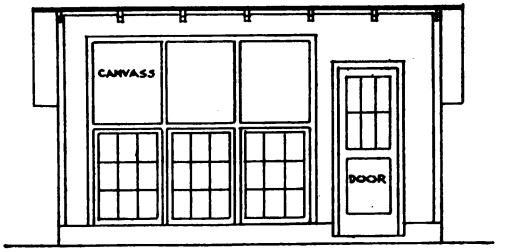

FIG. 57

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In adding to or taking from this plan, you can use the same method on different plans. The front or south has windows for the scratch pen, to admit the sun, and canvass above the windows for air. There are two windows on the north for ventilation in summer. (Fig. 57.)

HOG HOUSE

A brief description and cut of a hog house in this booklet may advance some ideas profitable to the farmer as well as the mechanic. The plan in the illustration is 24x40′ and should be set east and west. The depth of stalls is 10′ and the feed way 4′. (Fig. 58.) The height of outside walls

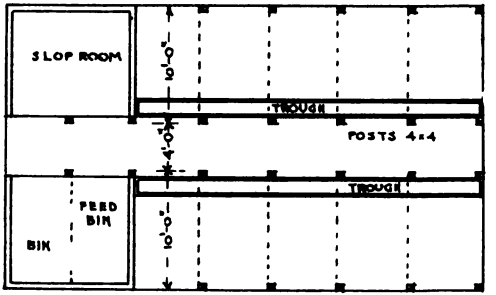

FIG. 58

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is 6′ to rafters. The north roof laps over the south roof far enough to admit a row of windows that will let the sunlight on the north floor. The troughs may be made of concrete. Arrange the partitions so they may be removed and hung on pins on the side. (Fig. 59.)

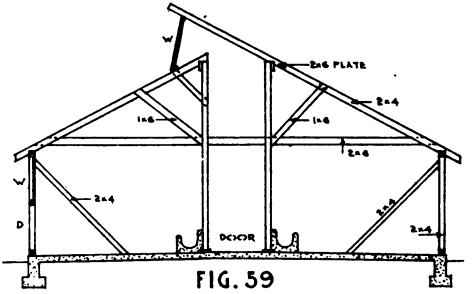

FIG. 59

Excavate for the wall 18″ below the surface and make the wall high enough above the surrounding grounds to keep a dry floor. Fill the walk with moist earth and tamp thoroughly. Concrete floor to be 4″ thick and extend 1″ over the wall. The center along feedway to be 2″ higher than the outside for drain. Place bolts in concrete on both sides of all openings not more

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than 6′ apart to bolt sills in place. The wall between the bin and stall to be 2″ to 4″ higher than the floor, to keep bin dry.

Place the sills and space for the studding. Cut a top plate the entire length and space the same as the sill. Cut the studs the proper lengths and nail to the plate. Raise and nail the bottoms on the sill. Set the inside posts 4″x4″, every 6′ on center, and 4′ apart in the clear for the feed way. The plates for the 4″x4″ posts to be 2″x6″. One nailed on the outside of the 4x4 and the top plate to lap over the side plate. There are 9½ base feet from the outside plate to the inside plate; 6″ rise to one base foot would make the inside plate 4′ 9″ higher than the outside plate. See common rafters for length and cut, or the base 12″ and rise 6″; laid 9½ successive times for the length.

TO ASSEMBLE A ROOF

We will use the same figure for this illustration that it may be easily understood, but the rules given in this roof have all the cuts for any regular roof. Though there may be a number of projections there will

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be no new cuts, but the method given will work on any rise or pitch.

In drawing an outline of a roof, take ¼" scale to represent one foot. The diagram is 20'x24'. The length of the ridge is the difference between the width and length of the building, 4'. Measure 10' from the ends to ridge and 10' from the sides to ridge. This locates the ridge. Draw a line 4' for the ridge and a line for the hip rafters from the corners to the ridge. This outlines a hip roof. (Fig. 60.)

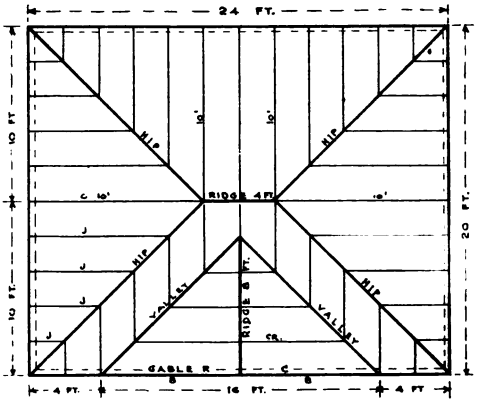

FIG. 60

The gable is 16', located in the center of

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one side of the building. The length of the ridge is ½ the width of the gable or 8′ to meet the main roof. The difference in the height of the gable ridge and the ridge of the hip roof is ½ the difference between the width of the gable, 16′, and the width of the main building, 20′, or 2′. The valley rafter extends from the mark on the plate for the width of the gable, to the 8′ mark on the ridge. (Fig. 60.) Spacing the rafters 2′ on center. There are five common rafters in the main roof. They extend from the plate to the ridge. There are 28 jack rafters, that extend from the plate to the hip rafter. There are 4 cripple rafters that extend from the valley rafter to the hip rafter and 1 cripple rafter that extends from the gable ridge to the ridge of the hip roof. The two gable rafters that extend from the plate to the ridge are common rafters. Cut off lower ends of gable rafters ½ thickness of valley rafter on same bevel as cripple rafters. There are six cripple rafters in the gable that extend from the valley to the ridge. (See fig. 13.)

Begin at the corners and space the rafters 2′ on center. Measure from the corner

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23″ and 25″ for the space of the first rafter and continue to space 2′ from these marks. Follow this method around the building except the 16′ span of the gable. Space the ridge of the gable 2′ center, the same as the plate. Let the gable ridge extend 1½″ longer than the 8′ mark to meet the valley rafter cut. Space the ridge of the main roof to correspond with the space on the plate. Allow 1¼″ extension at both ends of the 4′ ridge to meet the hip rafter, the center of the hip rafter to line with the 4′ mark. Draw the rafters from plate to ridge, plate to hip, valley to hip and valley to ridge. (Fig. 60.)

All roofs are laid out with this method. Draw an outline of the roof before cutting the rafters and check the rafters on the plat as you cut them to know where you left off cutting and where to begin. It is practical to fasten a pair of gauges on the square at 12″ base and the given rise to space and cut the rafters. It is as easy to cut a roof with 3″, 5″, 7″, or any other rise as it is with 8″ in this roof. Observe the methods. The common rafters have 10 base feet, ½ the width of the main roof. (Fig.

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60.) Lay the square on the rafter at 12″ base and 8″ rise. Mark on the rise for the ridge cut, and make a check mark at 12″ base. Move the rise of the square to this check mark and re-check as before ten successive times for the length of the common rafter. Then mark on the base for the plate cut. (Fig. 32.)

Shorten the rafter at the top one-half the thickness of the ridge. There are as many base feet in a jack rafter as there are number of feet on the plate from the corner to the center of the rafter. They are usually in pairs of the same length. Reverse the cuts on one to make a pair of right and left cuts. There are four pairs of jack rafters of the first length. They are 2′ from the corner and have two base feet. Lay the square on the rafter at 12″ base and 8″ rise, two successive times. For the length of the rafter, mark on the base for the plate cut and on the rise for the perpendicular cut to meet the hip rafter. If a heel and extension is left on see rule for same. For the angular or face cut to meet the hip, take the number of inches from 12″ base to 8″ rise, which is nearly 14½″ on the

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square instead of the rise with 12″ base. Lay the square on the top edge of the rafter at 12″ base and 14½″ at the plumb line and mark back from the perpendicular line on the 14½″. This method is true in any pitch. (Fig. 35.)

Take the pattern and make four duplicate rafters of the reverse cut. Take one of the four and make three duplicate rafters with the opposite cut the same as pattern and you have four pairs of rafters. There are four pairs of the second jack rafter. They are 4′ from the corner and have 4 base feet. Follow directions for length and cut of first pair. The third rafter is 6′ from the corner and has six base feet. There are three pairs and will require the square laid at the base and rise 6 successive times. For the length, use the same method as in the first pair for length and cut.

There are three pairs of the fourth jack rafter. They are 8′ from the corner and have 8 base feet. Follow the same method as former pairs. By marking back from the regular spacing or perpendicular line, the center of the jack rafter will be shortened enough for the thickness of the hip.

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The cripple rafter that extends from the valley rafter to the hip rafter has 4 base feet, the number of feet on the plate from the corner at the hip to the angle or center of the valley. Lay the square on the rafter at 12″ base and 8″ rise four successive times for the length of the cripple rafter. Mark on the rise for the perpendicular line for top and bottom to meet the hip and valley. Square across the rafter at the check mark for the valley and make the plumb line on the opposite side from the hip line.

The angular cut is obtained the same as for the jack rafter. The valley cut to be reversed on opposite side from the hip, the cuts running parallel. (Figs. 35 and 36.) The two gable rafters are common. They have eight base feet, ½ the number of feet in the width of the gable. (Refer to rule given for common rafter.) There are three pairs of cripple rafters that extend from the valley to the gable ridge. Every foot out on the ridge from the center of the valley at the intersection of valley and ridge lengthens the cripple rafter one base foot. The first pair of cripple rafters are

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set out 2′ and have 2 base feet. The second pair is set out 4′ and has 4 base feet. The third pair is set out 6′ and has 6 base feet. (Fig. 21.) Lay the square at 12″ base and 8″ rise as many times as there are base feet in the rafter for the length. Mark on the rise for the ridge cut, and down on the rise for the perpendicular cut to meet the valley. The face cut to meet the valley. See rule for cripple rafter to meet the valley rafter. The cripple from the gable ridge to the ridge of the main building. Sets in 2′ on the ridge from the hip and has two base feet. Obtain the length by laying the square at 12″ base and 8″ rise two successive times and cut square to rise as for ridge cuts. The base for the hip and valley rafter is 17″. (Fig. 16.) The hip rafter has 10 base feet, ½ the width of the building. Then 17″ base and 8″ rise laid on the rafter 10 successive times gives the length of the hip rafter. Mark on the base for the plate cut and on the rise for the perpendicular cut to meet the ridge. The face cut to meet the ridge, take the number of inches from 17″ base to 8″ rise, which is nearly 18¾″ with 17″ base and

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mark on the 18¾″ for the angular cuts. This rule is good in any number of inches rise. There are as many base feet of 17″ in the valley as there are number of feet in ½ the width of the gable. If the gable is 16′ there are 8 base feet in the valley. Lay the square at 17″ base and 8″ rise, eight successive times for the length. Mark on the base for the plate cut and on the rise for the plumb cut to meet the ridge. The angular cut is the same as used in the hip rafter.

TRUSS FRAMING

Truss framing is figured with the base 12″ and any rise to meet the objective point. The rules given in rafter framing will give any cut in truss framing, by raising and lowering the rise, the hypotenuse is the length of brace in one base foot.

Truss (fig. 61) is 16′ long, 4′ 6″ high. The outside braces have 3½ base feet and 3′ 6″ rise. There are as many inches rise to one base foot as there are number of inches in the rise divided by the number of base feet. Thus, 3′ 6″=42″÷by 3½ base feet=12″ rise to one base foot. The inside brace has 3

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base feet and 2′ 10″ rise equals 34″ rise ÷ by 3 base feet. = 11 1/3″ rise to one base foot. The length of brace is 12″ base and 11 1/3″ rise laid on the timber three successive times. Mark on the base at top and bottom, add the seat of brace, beyond those marks in the proportion of 4″ to 12″. (See fig. 61.)

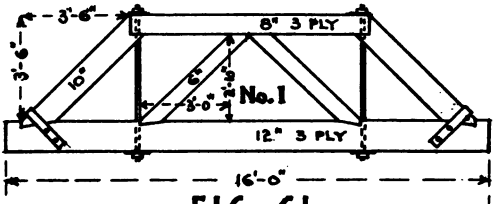

FIG. 61

There are 1″ iron rods with plates that extend from the top beam at the corner through the bottom beam. Where the outside brace is seated an iron clamp or stirrup laps over the bottom and is bolted to the beam. The beam is three thicknesses of 2″x12″.

Truss No. 2 is 20′ span with 12″ rise to 1 base foot. See rule for common rafters for length and cut of main or outside raft-

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ers. Place a cross tie from the plate to the opposite rafter 1/3 the distance down from the point of rafter to the plate. Put a horizontal tie up 1/3 the length of the rafter from the plate, and a tie from the ridge to the bottom tie, spiked between cross ties and at bottom. (See fig. 62.)

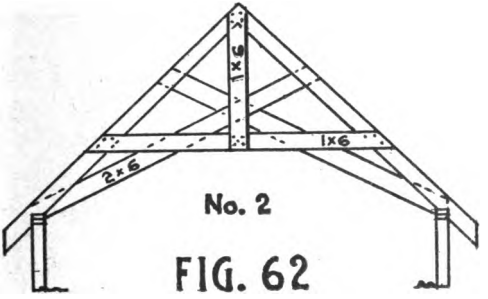

FIG. 62

Truss No. 3 spans 20′, 3″ rise to one base foot. See rule for common rafters for length and cut. Tie from ridge to cross tie. Place a brace from the center of

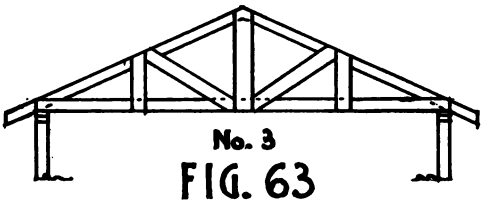

FIG. 63

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through tie to ½ way up the rafter, and a perpendicular tie from the center of the rafter to the cross tie.

Trusses No. 2 and No. 3 are used mostly in roof construction.

PRACTICAL HINTS

To divide a board in 2 or more equal parts, lay the rule across at any number that will give 2, 3 or more equal parts and mark and line for same, and there will be no fractional parts to figure. (Fig. 64.)

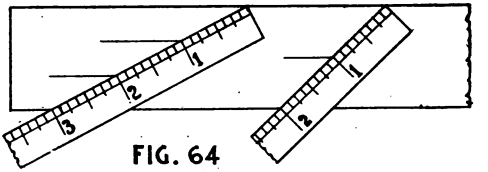

FIG. 64

To cut a mitre take the square at 12″ and 12″ or any other equal number of inches on the square. (To cut a mitre see fig. 65.)

To cope a mould or board cut an inside mitre and cut out the face of the mitre with a coping saw and the cope will fit the mould at right angle, also set a compass

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the proper width, hold in the same angle as you mark down, and cut to mark. (Fig. 66.)

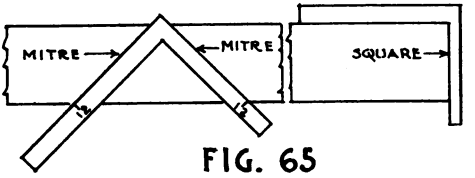

FIG. 65

FIG. 66-A

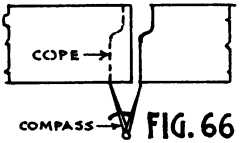

FIG. 66

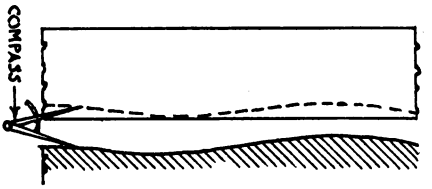

FIG. 67

To cope a board to an uneven surface, set the board plumb and scribe with a pencil compass, from top to bottom, holding the compass at the same angle.

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STRAIGHT EDGE

A straight edge to level walls and buildings should be made of 1⅛″x8″x16′ of edge grain lumber to prevent warping. Straighten the bottom of the straight edge. Measure to the center of the board and from this mark measure 18″ on either side. From this point draw a line to the end 4½″ from the bottom and up the taper line and gauge the same width from the bottom in the center of the board to the tapered lines. Cut a handhold in the center 1¼″ wide by 4″ long, leaving 1½″ on the top edge. Set a true level on the top edge. Level the board, reverse the straight edge on the same bearings, if the bulb centers the straight edge is true, if not, plane off the high point on the top edge until it reverses the same. The plumb straight edge should be 4½″ wide and the length of the height of upper plate. Put a ⅞ block on each end to keep the board clear from any timber that may be bowed. Make perfectly straight, and see the ends measure the same width.

The straight edge to set the jambs, line cabinet work, etc., straighten and gauge the same width the entire length. That in

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straightening a jamb, it can be plumbed at the same time. To test a straight edge, lay it on the floor, draw a line reverse the board end to end, draw another line. If the lines are parallel, the edge is straight, if not, plain the defects until it reverses the same. (Fig. 68.)

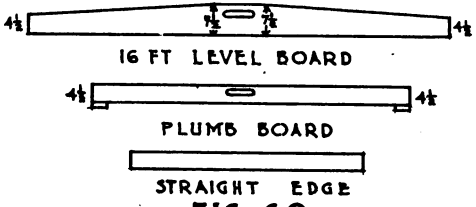

FIG. 68

TEST A SQUARE

Place and fasten a straight edge on a smooth wall or surface, set the square on the straight edge and draw a line the length of the square on the wall. Reverse the square to the opposite side of the line and draw another line. If the lines run parallel, the square is true, if the lines divide, it is not true. Draw a line centered of the divided lines, and file the edge of the square until it reverses the same. (Fig. 69.)

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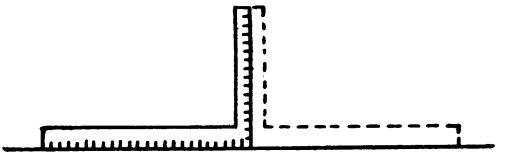

FIG. 69

TEST A LEVEL

Drive a nail in a smooth even wall, to set one end on. Adjust the other end until the bulb is centered on the glass, and draw a line the length of the level. Reverse the opposite end of the level on the nail, center the bulb and draw another line. If the lines are parallel, the level is true; if they divide, it is not true. Take ½ the distance of the divided lines and draw a line from this point to the intersection of the lines for the level line, and adjust the level to the center line, and the level will be true. (Fig. 70.)

FIG. 70

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2nd. Set it on an even surface and adjust the level until the bulb centers, reverse the level end to end, if the bulb centers, the level is true; if not, adjust the level until the bulb will come to the same place in reversing the level. (Fig. 70.)

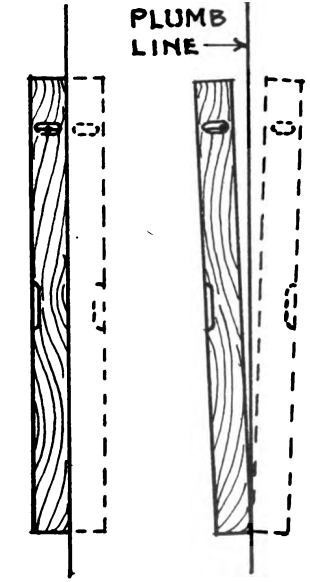

FIG. 71

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TEST A PLUMB

Place the plumb on a smooth wall, hold the plumb to center the bulb and draw a line the length of the plumb stock, reverse the plumb to the opposite side of the line and draw a line the length of the plumb, if the lines are parallel, the plumb is true; if the lines divide at one end, it is not true. Make a mark ½ the distance between the divided lines and draw a line from this mark to the intersection of the two lines, then adjust the plumb to the center, or plumb line. (Fig. 71.)

WORK BENCH

A work bench 8′ or 10′ long, 2′ in width and 3′ high, or height of thigh joint, makes a convenient bench to move to any room in finishing, and when a longer length is needed, hook on an extension. It should be equipped with a bench screw, and clamp, also with a bench stop on the top, that can be lowered and raised for any thickness of board.

The dimension of lumber for the bench, 4 pieces of 2″x4″x3′ for the legs, 4 pieces of 2″x4″x2′ for top supports. Nailed be-

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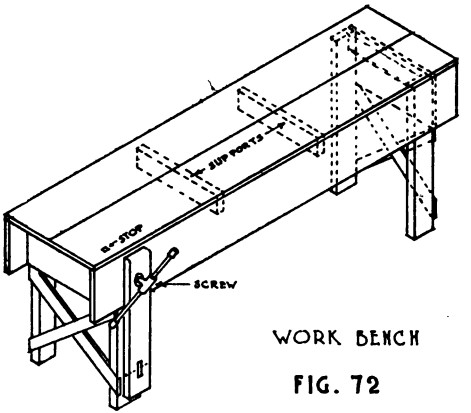
tween the side boards. One piece 3x4 hard wood for clamp. Two pieces 1″x12″x10′ for side boards. Two pieces 1¼″x12″x10′ for top. Four pieces 1″x4″x3′ for braces. Straighten the top edge of side boards and outer edge of top to form a straight corner to work from. (Fig. 72.)



WORK BENCH

FIG. 72

SAW TRESTLE

The height of trestle for the average man is nearly 2′. The top should be made of 2″x6″x4′, the legs of 1⅛″x5″ boards. The bottom of the legs may be tapered 1″ narrower than the top. Set the legs in from

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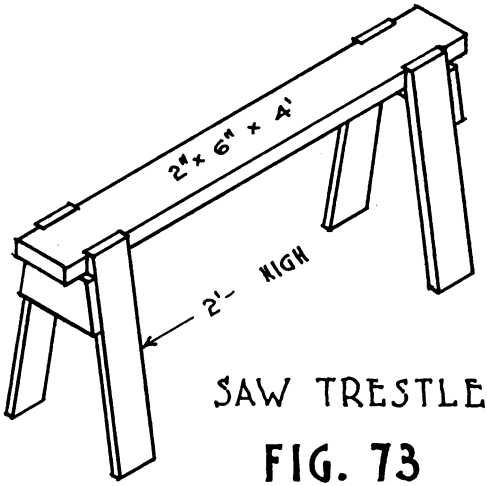
the end 4″. Notch in the side for the leg at an angle so the bottom of the legs will be spread 16″ and out in line of the end of the top to brace endwise. Nail a cross tie on the legs under the top of trestle. Set the trestle on a level floor, and compass and saw the bottom of the legs parallel to the floor. (Fig. 73.)



SAW TRESTLE

FIG. 73

SAWS

The length of saw and gauge of tooth for practical purposes:

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The Rip Saw, 28″ blade, 5 points to 1″.

The Cutoff Saw, 26″ blade, 8 points to 1″.

The Finish Saw, 22″ blade, 11 points to 1″.

The Compass Saw, 14″ blade, 8 points to 1″.

Hold the saw at right angle to your body nearly 45 degrees upright; make an even stroke forward with a slight pressure, lowering the handle and raising the point in shoving forward. To clear the chips and keep cutting the length of stroke, keeping the right eye in line of the saw to see that the saw does not run sideways. Prevent any side motion if possible.

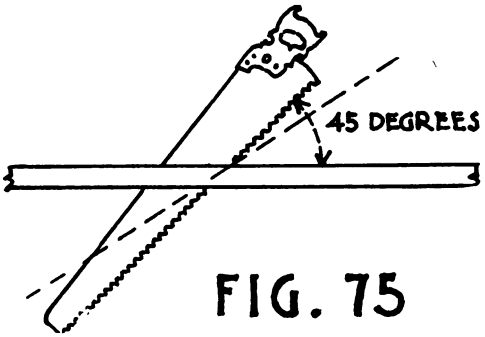

FIG. 75

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SETTING AND FILING SAWS

Set every other tooth with the point out, then reverse the saw and set the other side in the same manner. Place the saw in the vise with the teeth as close to the clamp as possible for filing to prevent vibration. File toward the point of the saw, keeping the points the same height and the front edge of the tooth slightly back from perpendicular by holding the file at the same angle for all teeth, hold the file back 20 degrees, and upright at nearly 25 degrees; the more the file is angled, the longer the point. Cut the same amount off of each tooth to keep them even. (Fig. 74.)

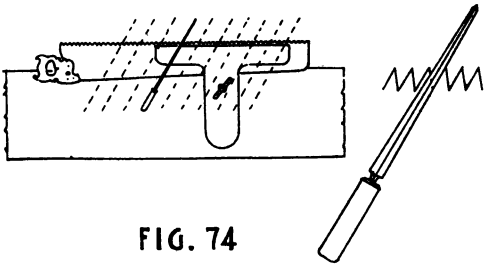

FIG. 74

PLANES

The planes most commonly used are the

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jack plane, fore plane, jointer plane, smoothing plane, and block plane. The jack plane is used to cut the rough surface of boards and timbers, and to cut the high places of a board before using the jointer. It is the roust about plane of planes. The fore plane is used to fit sash and doors. It is also used in cutting the uneven edge of a board before using the jointer. The jointer is used to straighten and join boards, and is frequently used instead of the fore plane to fit the sash and doors. The smoothing plane is used to surface a board to a smooth surface. Begin planing at the fore end of the board and work back, also at one side and work across. Shove the plane straight forward, not swerving it sideways. In shoving the plane forward near the end of stroke, gradually raise the back end of the plane to raise the bit at end of stroke to prevent any plane marks, and keep it raised high enough to clear the bit in drawing the plane back. Drawing the plane back with the weight on the bit dulls it more than the cutting. Those methods should be observed with all planes. The block plane is used to

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plane the ends of board and mould joints, and in close fitting. The bit should be ground back at 60 degrees, keeping the edge squared to the sides, then finish on an oil stone to a keen edge. (Fig. 76.)

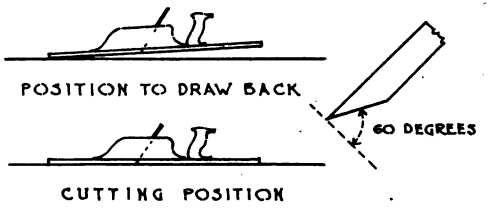

FIG. 76

SCAFFOLD

Set 2″x4″ around the building about 10′ apart for upright posts. Nail a clear strong board on the 2x4 at the proper height for the scaffolding. Saw a notch in a short board, or 2x4 the width of the bracket. Nail the block on the bracket and to the building. Put a tie of 1x6 sheeting in line of the brackets to all upright posts, put a cross brace on the uprights, from bottom to line of scaffolding, using 2″x10″ or 12″ plank for the scaffolding. High scaffolding should have heavier upright posts.

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